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Studies on aquatic angiosperms of Rajshahi district, Bangladesh with reference to important medicinal plants

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Abstract

Studies on aquatic angiosperms of Rajshahi district, Bangladesh was carried out during January 2023 to December 2023. A total of 42 species belonging to 36 genera and 23 families were collected and identified. Among the aquatic angiosperms, Magnoliopsida (Dicotyledones) is represented by 30 species; whereas Liliopsida (Monocotyledones) is represented by 12 species. The family Polygonaceae contained the highest number of plants followed by Nymphaeaceae, Poaceae, Cyperaceae, Euphorbiaceae, Convolvulaceae, Onagraceae, Araceae, Hydrocharitaceae, Pontederiaceae, Commelinaceae was dominant families in the study area. In the research area, 26 species were common and 16 species were rare. Twenty four (24) medicinal plants have been documented with their uses for the cure of more than 17 diseases, and some of these are dysentery, fever, constipation, asthma, arthritis, diarrhea and skin disorders, snake bite, asthma, diabetes, inflammation, malaria, stomach disorders, anticancer, antioxidant, anti-inflammatory, antimicrobial, skin whitening, insecticidal activities, infertility, heart diseases, dysentery, and indigestion, epilepsy and others. The present study will help in identifying the aquatic angiosperms for further investigation and also beneficial to develop the herbal drug development.

Key words: *Aquatic angiosperms, medicinal plants, Rajshahi, Bangladesh*

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1. Introduction

Diversity of plant is essential base of most of terrestrial ecosystem. All including animals are totally dependent on plant diversity directly or indirectly for not only food energy but also for all necessary of daily life. Globally, tens of thousands of species of higher plants and several hundred lower plants are currently used by humans for a wide variety of purposes as food, fuel, fiber, oil, herbs, spices, industrial crops and as forage and fodder for domesticated animals. Approximately, 25000-30000 plant species has been used by the people of tropical countries and up to 25000 species have been used in traditional medicines (Heywood, 1993). In addition, many thousands of species are grown as ornamentals in parks, public and private gardens, as avenue trees

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and for shade and shelter. Another important role of plant diversity in the provision of ecosystem services including clean environment, the protection of watersheds, stabilization of slopes, improvement of soils, moderation of climate and the provision of a habitat for much of our wild fauna. Currently, plant diversity of the world has been facing tremendous amount of threats from humanity. The threats posed by human are urbanization, commercial agriculture, tree plantations, logging and wood extraction, mining and transportation, pollution, over harvesting, tourism, biological invasion, exotic monoculture plantations. Some natural events and disasters that also have an impact on the plant diversity in different habitats.

The survey of aquatic plant diversity is very much important because it provides baseline information for comparison after modification of the habitats and to monitor changes in biodiversity overtime. Survey results are useful to determine the presence or rare, threatened, exotic, natives, pest and medicinal plant species. Currently the survey results have also been used to investigate the potential impact of planned developments and to inform management programs to make decision for biodiversity conservation. Data on aquatic plant diversity are also essential for students, researchers, biodiversity management planners, social foresters, NGOs, district gazetteers and other enthusiastic persons who fascinated for plants.

Studies on the aquatic plants and medicinal uses were carried out in Bangladesh by Basak *et al.* (2015), Kaiser *et al.* (2016) and Rahman *et al.* (2007), Zahra and Rahman (2018), Uddin *et al.* (2013), Sarker and Rahman (2016), Rahman and Debnath (2014), Roy and Rahman (2018), Rahman *et al.* (2014), Rahman (2021), Debnath and Rahman (2017), Sarker and Rahman (2019), Sarker and Rahman (2017), Rahman and Mamun (2017), Nahar and Rahman (2016), Roy and Rahman (2018), Rahman and Jamila (2015), Rahman and Rahman (2014), Rahman *et al.* (2014), Kona and Rahman (2015), Rahman *et al.* (2015), Faria *et al.* (2021), Khatun *et al.* (2022), Islam and Rahman (2023) and Keya and Rahman (2017). But no such aquatic plant survey and documentation research were found of Rajshahi district of Bangladesh.

2. Materials and methods

The work is based on fresh materials collected during twenty six visits of Rajshahi district of Bangladesh from January 2023 to December to cover the seasonal variations. The visits covered all types of aquatic habitats of the study area. A total of 42 species belonging to 36 genera and 23 families were collected and identified. Medicinal information was obtained through semi-structured interviews with knowledgeable traditional healers. A total of 54 informants having an age range of 26-77 years were interviewed using the semi-structured interviewed method (Alexiades, 1996). Plant parts with either flowers or fruits were collected using traditional herbarium techniques to make voucher specimens for documentation.

Collected plant species were authentically identified with the help of various books (Hooker, 1877; Prain, 1903; Ahmed *et al.*, 2009). For the current name and up-to-date nomenclature Huq (1986), Pasha and Uddin (2013) were also consulted.

3. Results and discussion

Diversity of aquatic angiosperms in Rajshahi district, Bangladesh was carried out from January 2023 to December 2023. A total of 42 species belonging to 36 genera under 23 families were recorded (Table 1). Out of

Table 1: Recorded aquatic plant species in the study area

S. No.	Scientific name	Local name	Family name	Habit	Status of occurrence	Voucher number
1	<i>Aeschynomene indica</i> L.	Shola	Fabaceae	Shrub	Rare	SA01
2	<i>Alternanthera philoxeroides</i> (Mart.) Grieseb	Malancha Shak	Amaranthaceae	Herb	Common	SA02
3	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Sachi Shak	Amaranthaceae	Herb	Common	SA03
4	<i>Chrozophora plicata</i> L.	Khudiokra	Euphorbiaceae	Herb	Rare	SA04
5	<i>Colocasia esculenta</i> (L.) Schott.	Kochu	Araceae	Herb	Common	SA05

Table 1 (Cont.)						
S. No.	Scientific name	Local name	Family name	Habit	Status of occurrence	Voucher number
6	<i>Commelina benghalensis</i> L.	Kanshira	Commelinaceae	Herb	Rare	SA06
7	<i>Commelina longifolia</i> Lamk.	Kanshira	Commelinaceae	Herb	Rare	SA07
8	<i>Coix lachryona-jobi</i> L.	Kuch	Poaceae	Herb	Rare	SA08
9	<i>Cyperus rotundus</i> L.	Mutha ghas	Cyperaceae	Herb	Common	SA09
10	<i>Cyperus difformis</i> L.	Chancha	Cyperaceae	Herb	Common	SA10
11	<i>Eichhornia crassipes</i> (Mart.) Solms.	Kochuripana	Pontederiacdeae	Herb	Common	SA11
12	<i>Enhydra fluctuans</i> Lour.	Helencha	Asteraceae	Herb	Rare	SA12
13	<i>Hygrophila auriculata</i> (Schum.) Heine.	KuluKhere	Acanthaceae	Herb	Rare	SA13
14	<i>Hydrilla verticillata</i> (L. f.) Royle.	Kureli	Hydrocharitaceae	Herb	Rare	SA14
15	<i>Ipomoea aquatica</i> Forssk.	Kalmi Shak	Convolvulaceae	Herb	Common	SA15
16	<i>Ipomoea fistulosa</i> Mart. ex Choisy	Dholkolmi	Convolvulaceae	Shrub	Common	SA16
17	<i>Kyllinga monocephala</i> Rottb.	Nirbishi	Cyperaceae	Herb	Common	SA17
18	<i>Lippia alba</i> L.	Boro Buiokra	Verbenaceae	Shrub	Common	SA18
19	<i>Lemna perpusilla</i> Torrey	Khudipana	Lemnaceae	Herb	Common	SA19
20	<i>Ludwigia adscendens</i> (L.) H. Hara.	Kesoredam	Onagraceae	Herb	Common	SA20
21	<i>Ludwigia perennis</i> L.	Kesordam	Onagraceae	Herb	Common	SA21
22	<i>Monochoria hastata</i> (L.) Solms.	Boronouka	Pontederiaceae	Herb	Common	SA22
23	<i>Monochoria vaginalis</i> (Burm.f.) C. Presl.	Sarkachu	Pontederiaceae	Herb	Common	SA23
24	<i>Najas graminea</i> Delile.	Naja	Najadaceae	Herb	Rare	SA24
25	<i>Nelumbo nucifera</i> L.	Padma	Nelumbonaceae	Herb	Rare	SA25
26	<i>Nymphaoides indicum</i> (L.) Kuntz.	Chand mala	Menyanthaceae	Herb	Common	SA26
27	<i>Nymphaea nouchali</i> Burm.f.	Sapla	Nymphaeaceae	Herb	Common	SA27
28	<i>Nymphaea rubra</i> Roxb. ex Andr.	Lal Shapla	Nymphaeaceae	Herb	Common	SA28
29	<i>Ottelia alismoides</i> (L.) Pers.	Shamakola	Hydrocharitaceae	Herb	Common	SA29

Table 1 (Cont.)						
S. No.	Scientific name	Local name	Family name	Habit	Status of occurrence	Voucher number
30	<i>Oxalis corniculata</i> L.	Amrul	Oxalidaceae	Herb	Common	SA30
31	<i>Persicaria barbatum</i> L.	Bikatali	Polygonaceae	Herb	Rare	SA31
32	<i>Persicaria hydropiper</i> (L.) Del.	Biskatali	Polygonaceae	Herb	Rare	SA32
33	<i>Persicaria orientalis</i> (L.) Spach	Boro biskatali	Polygonaceae	Shrub	Common	SA33
34	<i>Pistia stratiotes</i> L.	Topapana	Araceae	Herb	Common	SA34
35	<i>Phyllanthus reticulatus</i> Poir.	Panisitki	Euphorbiaceae	Shrub	Common	SA35
36	<i>Saccharum spontaneum</i> L.	Kash	Poaceae	Shrub	Common	SA36
37	<i>Scirpus articulatus</i> (L.) Palla.	Chechur	Cyperaceae	Herb	Common	SA37
38	<i>Trapa bispinosa</i> Roxb.	Paniphol	Trapaceae	Herb	Rare	SA38
39	<i>Typha elephantina</i> Roxb.	Hogla	Poaceae	Shrub	Rare	SA39
40	<i>Utricularia aurea</i> Lour.	Jhagi	Lentibulariaceae	Herb	Rare	SA40
41	<i>Vetiveria zizanioides</i> (L.) Nash.	Binna ghas	Poaceae	Herb	Common	SA41
42	<i>Xanthium indicum</i> Koenig.	Ghagra	Asteraceae	Herb	Common	SA42

the recorded species, 30 species were Magnoliopsida (Dicotyledones) and 12 species were Liliopsida (Monocotyledons). Family Polygonaceae is the most dominant in all families followed by Nymphaeaceae, Poaceae, Cyperaceae, Euphorbiaceae, Convolvulaceae, Onagraceae, Araceae, Hydrocharitaceae, Pontederiaceae, Commelinaceae was dominant families in the study area. Out of 42 species, 26 species were common and 16 species were rare in the research area. Out of the recorded species, Hijal (*Barringtonia acutangula* (L.) Gaertn.), Koranja (*Pongamia pinnata* (L.) Pierre), Pidali (*Trewia nudiflora* L.) and Khoksha Dumur (*Ficus hispida* L. f.) were water tolerance species in the study area.

In Magnoliopsida (dicot) the largest families are Onagraceae and Nymphaeaceae contains 4 and 2 species, Lentibulariaceae, Amaranthaceae contains 3 and 2 species. Lythraceae, Polygonaceae, Menyanthaceae, Acanthaceae and Convolvulaceae contains 2 species and rest families contains 1 species. In this research, 46% plant species in the study area found to be rare, 44% species found as common and 10% species found as abundant (Figure 1). In the aquatic habitat, 37% like to grow along the water's edge, 13% as submerged, 11% as emergent, 11% as free floating, and 28% as rooted floating (Figure 2). Flowers are produced on the water's surface by submerged species. Fruits are kept under water until they reach maturity after pollination. Out of the recorded species, 22% were medicinal, 9% vegetable, 4% aquarium plant, 6% edible, 10% fish food, 49% fodder (Figure 3).

The recorded species is comparable with the results of other studies in Bangladesh. Magnoliopsida (Dicots) has 14 families, 19 genera, and 26 species, while Liliopsida (Monocots) has 9 families, 17 genera, and 16 species. Kaiser *et al.* (2016) discovered 22 species in Bangladesh's Noakhali Sadar, divided into 16 families and 21 genera. The greatest families in Magnoliopsida are Nymphaeaceae and Onagraceae, which have 2 and

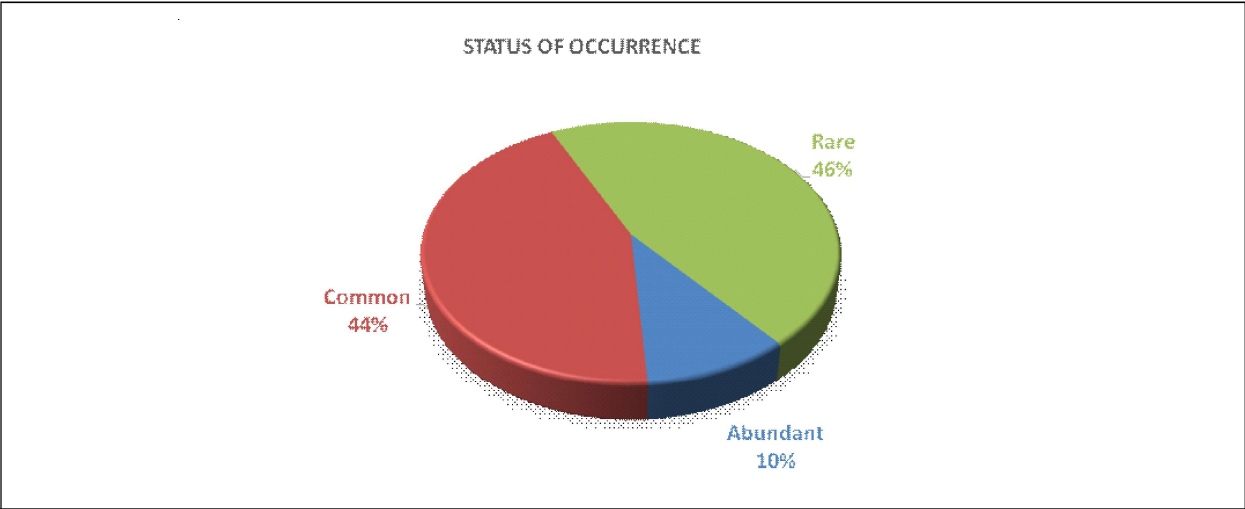


Figure 1: Recorded status of occurrence

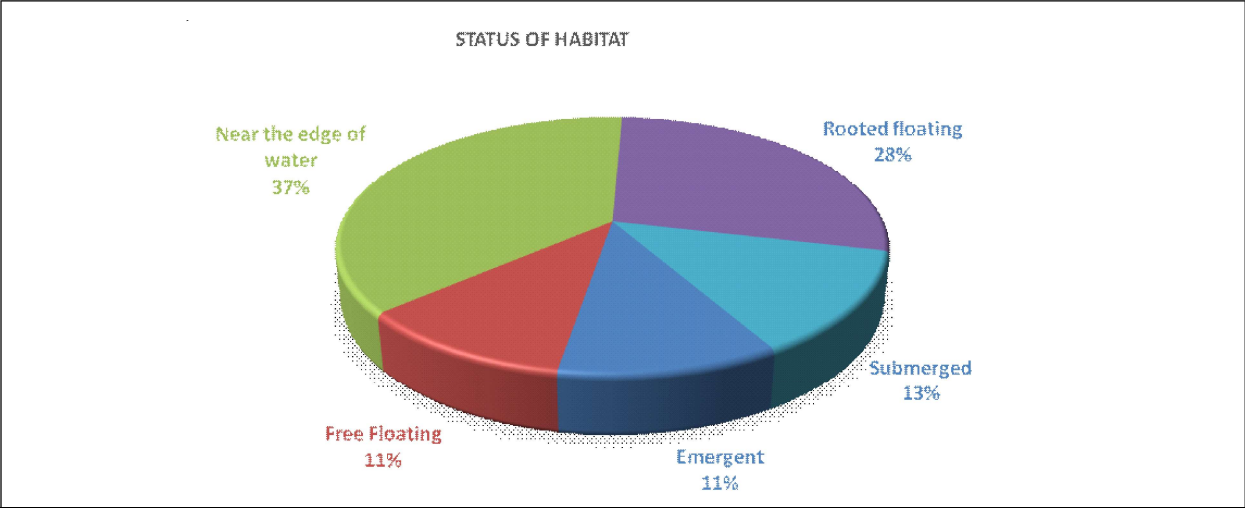


Figure 2: Recorded status of habitat

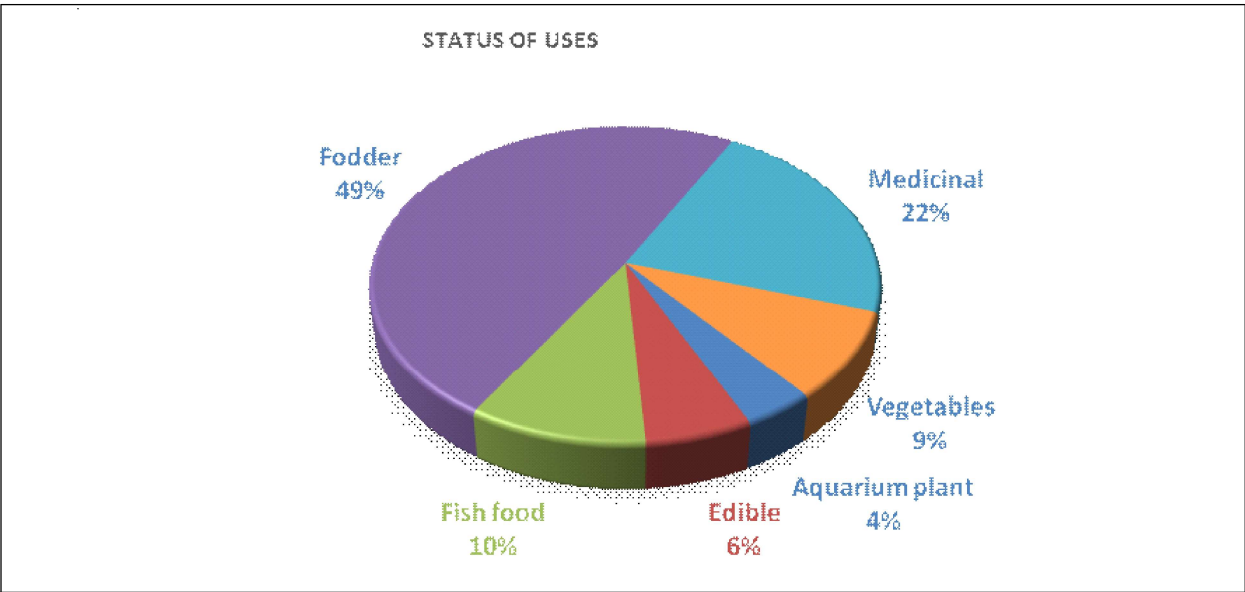


Figure 3: Recorded status of uses

4 species each, whereas the largest families in Liliopsida are Cyperaceae and Poaceae, which contain 4 and 3 species each, comparable to Rahman and Debnath (2014). Asteraceae (7 species) in Magnoliopsida and Poaceae (7 species) in Liliopsida are the two biggest families, according to Rahman and Debnath (2014). In Magnoliopsida, Sajib *et al.* (2014) identified the biggest Fabaceae family (23 species) and Poaceae (16 species) in Liliopsida.

Herbs and shrubs are examples of plant life forms. There are 49 herb species and three shrub species in the research area, which is lower than Sajib *et al.* (2014). Herbs, shrubs, trees, and climbers were all represented by 174, 53, 96, and 22 species, respectively, according to Sajib *et al.* (2014). In Manikganj sadar upazila, Sarker *et al.* (2013) discovered 58% of plant species. *Alloteropsis cimicina*, *Alternanthera philoxeroides*, *Alternanthera sessilis*, *Azolla filiculoides*, *Azolla pinnata*, and other plant species are the most prevalent. *Actinoscirpus grossus*, *Ipomoea fistulosa*, *Hygrophila phlomoides*, and other shrubs are the most prevalent. Both the Dicotyledons and Monocotyledons groups have fewer numbers than Alam *et al.* (2006), Rahman and Debnath (2014). Alam *et al.* (2006) found a total of 187 species in the Angiospermic flora of Ghagotia Union under Kapasia Upazila in Gazipur district, with 133 dicots and 54 monocots. In Pandit Para Village, Palash Upazila, Narsingdi District, Rahman and Debnath (2014) found 53 Magnoliopsida (Dicotyledones) families, 112 genera, and 136 species of Magnoliopsida (Dicotyledones) and 12 Liliopsida (Monocotyledones) families, 24 genera, and 26 species of Liliopsida (Monocotyledones).

The local peoples of Rajshahi district continue to rely on medicinal plants used for the treatment of various ailments like wound healing, urinary tract infection, hepatitis, dysentery, fever, constipation, asthma, arthritis, diarrhea and skin disorders, snake bite, sedative, asthma, arthritis, diarrhea and skin disorders, diabetes, and inflammation, malaria, and stomach and bowel disorders, anticancer, antioxidant, anti-inflammatory, antimicrobial, skin whitening, larvicidal, and insecticidal activities, Infertility, diabetes, heart diseases, dysentery, and Indigestion, epilepsy, depression, dementia and neurodegenerative maladies, genitourinary system, liver, kidney, and spleen, arthritis, epilepsy, snake bite, insect bite, lumbago, malaria, diarrhea, astringent, diuretic and other diseases.

The treatment of different diseases was frequently used species like *Aeschynomene indica* L., *Alternanthera philoxeroides* (Mart.) Grieseb., *Alternanthera sessilis* (L.) R.Br. ex DC., *Chrozophora plicata* L., *Colocasia esculenta* (L.) Schott., *Commelina benghalensis* L., *Cyperus rotundus* L., *Eichhornia crassipes* (Mart.) Solms., *Enhydra fluctuans* Lour., *Hygrophila auriculata* (Schum.) Heine., *Ipomoea aquatica* Forssk., *Ipomoea fistulosa* Mart. ex Choisy, *Lippia alba* L., *Ludwigia adscendens* (L.) H. Hara., *Ludwigia perennis* L., *Nelumbo nucifera* L., *Nymphaea nouchali* Burm.f., *Oxalis corniculata* L., *Persicaria hydropiper* (L.) Del., *Phyllanthus reticulatus* Poir., *Trapa bispinosa* Roxb., *Xanthium indicum* Koenig (Table 2). Similar results of medicinal plant families in the study is in agreement with Anisuzzaman *et al.* (2007), Rahman *et al.* (2008), Rahman *et al.* (2010), Rahman and Asha (2021), Islam and Rahman (2018), Sarker and Rahman (2017), Yasmin and Rahman (2017).

Table 2: Medicinal plants used by the local peoples of Rajshahi district, Bangladesh

S. No.	Scientific name	Local name	Family name	Medicinal Uses
1	<i>Aeschynomene indica</i> L.	Shola	Fabaceae	Aerial parts are used for wound healing, and to treat urinary tract infection, hepatitis, dysentery.
2	<i>Alternanthera philoxeroides</i> (Mart.) Grieseb	Malancha Shak	Amaranthaceae	Whole plant is used as fever and constipation.
3	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Sachi Shak	Amaranthaceae	Roots are uses as inflamed wounds.
4	<i>Chrozophora plicata</i> L.	Khudiokra	Euphorbiaceae	Whole plant is used in the treatment of jaundice and to purify the blood.

Table 2 (Cont.)				
S. No.	Scientific name	Local name	Family name	Medicinal uses
5	<i>Colocasia esculenta</i> (L.) Schott.	Kochu	Araceae	Plants are used for treatment of various ailments including asthma, arthritis, diarrhea and skin disorders.
6	<i>Commelina benghalensis</i> L.	Kanshira	Commelinaceae	Whole plant is used as leprosy, sore throat, ophthalmia, burns, pain and inflammation.
7	<i>Coix lachryona-jobi</i> L.	Kuch	Poaceae	Plant is used as diuretic, spleen, lung, stop diarrhea.
8	<i>Cyperus rotundus</i> L.	Mutha ghas	Cyperaceae	Whole plant is used as diarrhea, diabetes, and inflammation, malaria, and stomach and bowel disorders.
9	<i>Eichhornia crassipes</i> (Mart.) Solms.	Kochuripana	Pontederiacdeae	Whole plant is used as anticancer, antioxidant, anti-inflammatory, antimicrobial, skin whitening, larvicidal, and insecticidal activities.
10	<i>Enhydra fluctuans</i> Lour.	Helencha	Asteraceae	Whole plant is used as inflammation, cancer, diarrhea, microbial infection, diabetes.
11	<i>Hygrophila auriculata</i> (Schum.) Heine.		KuluKhere	Acanthaceae Whole plant is used for the treatment of pain, jaundice, malaria and as an aphrodisiac.
12	<i>Ipomoea aquatica</i> Forssk.	Kalmi Shak	Convolvulaceae	Whole plant is used against piles, and nosebleeds, as an anthelmintic, and to treat high blood pressure.
13	<i>Ipomoea fistulosa</i> Mart. ex Choisy	Dholkolmi	Convolvulaceae	Leaves are used as fever, headache, and respiratory infections. Whole plant is used to treat digestive problems, such as diarrhea and dysentery.
14	<i>Lippia alba</i> L.	Boro Buiokra	Verbenaceae	Leaves and roots are used gastric diseases, antipyretic disease.
15	<i>Ludwigia adscendens</i> (L.) H. Hara.	Kesoredam	Onagraceae	Leaf extract is used as various skin diseases.
16	<i>Ludwigia perennis</i> L.	Kesordam	Onagraceae	Whole plant is used as fever.
17	<i>Nelumbo nucifera</i> L.	Padma	Nelumbonaceae	Seed is used in the treatment of inflammation, cancer, diuretics, and skin diseases, poor digestion, chronic diarrhea, enteritis, and cancer.
18	<i>Nymphaea nouchali</i> Burm.f.	Sapla	Nymphaeaceae	Roots, leaves, and flowers are useful in the treatment of Infertility, Diabetes, Heart Diseases, Dysentery, and Indigestion.
19	<i>Nymphaea rubra</i> Roxb. ex Andr.	Lal Shapla	Nymphaeaceae	Plant is used in the treatment of piles, bleeding nose and dysentery.

Table 2 (Cont.)				
S. No.	Scientific name	Local name	Family name	Medicinal Uses
20	<i>Oxalis corniculata</i> L.	Amrul	Oxalidaceae	Whole plant is used in the treatment of neurological disorders like epilepsy, depression, dementia and neurodegenerative maladies.
21	<i>Persicaria hydropiper</i> (L.) Del.	Biskatali	Polygonaceae	Whole plant is used in treatment of hemorrhoids, anti-fertility, diarrhea, and dyspepsia.
22	<i>Phyllanthus reticulatus</i> Poir.	Panisitki	Euphorbiaceae	Leaves are antidiarrheal and roots are used for asthma. Fruit of the plant is used in inflammation. Bark is used as astringent and diuretic.
23	<i>Trapa bispinosa</i> Roxb.	Paniphol	Trapaceae	Nuts are used in the problems of stomach, genitourinary system, liver, kidney, and spleen
24	<i>Xanthium indicum</i> Koenig.	Ghagra	Asteraceae	Extracts of whole plant, leaves, root, flower, and fruit can be used in the treatment of fungal infection, arthritis, epilepsy, snake bite, insect bite, lumbago, malaria, diarrhea.

4. Conclusion

A preliminary survey in Rajshahi resulted in recording of total 42 aquatic plant species. They are belonging to 35 genera under 30 families. Among them, Dicotyledons is represented by 17 families whereas Monocotyledons are represented by 12 families. In Magnoliopsida, Nymphaeaceae and Onagraceae are the largest family each of them contain 2 and 4 species, whereas in Liliopsida the largest families are Cyperaceae and Poaceae contains 4 and 3 species. The investigation recorded a number of rare aquatic plant, species from the study area. These are *Trapa bispinosa* (Singara), *Nelumbo nucifera* (Padma), *Nymphaea pubescens* (sada shapla), *Oenanthe javanica* (Panidhone), *Nymphaea rubra* (lal shapla), *Ottelia alismoides* (Shamakola), *Enhydra fluctuans* (Helencha) and *Centrostachys aquatica* (thuash). Twenty four (24) medicinal plants have been documented with their uses for the cure of more than 17 diseases, and some of these are vomiting, worm, asthma, cough, cold, menstrual disease, paralysis, headache, heart disease, itches, wound piles, skin diseases, jaundice, snake bite, sex problems, toothache, chicken pox, constipation, dysentery, diarrhea, diabetes, eczema, fever and others. The present study will help in identifying the aquatic angiosperms for further investigation and also beneficial to develop the herbal drug development.

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